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AUTHOR Bates, A. W.
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ABSTRACT

Designed to stimulate course planning teams to consider a wide range of technological options at the start of the course design process, this paper focuses on ways in which technology can be used to design, produce, and present European-wide distance education courses. The more detailed objectives of the paper are to look at how technology may facilitate the joint production of courses across different institutions in different countries; speed up course production; help in the delivery of courses to different target groups in different countries; and suggest prototype course designs that meet the challenge of the first three objectives and might attract some external funding. Factors to be considered in determining the suitability of technology for distance teaching are then considered, including access and availability to students, costs, teaching functions, interaction and user-friendliness, organizational constraints, and novelty. Scenarios for media use in European courses are also suggested; these include electronic publishing, videocassette courses, tutored video instruction, computer-mediated communication, and computer-based learning with videodiscs. The paper concludes by identifying several policy issues that need to be resolved by the European Association of Distance Teaching Universities before final choices can be made about the use of technology in European-wide courses. (5 references) (MES)

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EUROPEAN ASSOCIATION OF DISTANCE TEACHING UNIVERSITIES

Working Group on Media and Technology

TOWARDS A EUROPEAN ELECTRONIC UNIVERSITY: TECHNOLOGY AND COURSE DESIGN FOR EUROPEAN-WIDE DISTANCE EDUCATION COURSES

Dr. A.W.Bates
Professor of Educational Media Research,
The Open University,
Walton Hall,
Milton Keynes,
United Kingdom

June, 1989

The European Association of Distance Teaching Universities (EADTU) was established on the 17th January 1987.
The member institutions are (May 1989):

- StOHO - Studiecentrum Open Hoger Onderwijs v.z.w., Belgium
- JAU - Jysk Aabent Universitet, Denmark
- DIFF - Deutsches Institut für Fernstudien an der Universität Tübingen, Federal Republic of Germany
- FernU - FernUniversität, Federal Republic of Germany
- FIED - Fédération Interuniversitaire de l'Enseignement à Distance, France
- NDEC - National Distance Education Centre, Republic of Ireland
- CUD - Consorzio per l'Università a Distanza, Italy
- Ou - Open universiteit, The Netherlands
- NADE - Norwegian Association for Distance Education, Norway
- UA - Universidade Aberta, Portugal
- UNED - Universidad Nacional de Educación a Distancia, Spain
- SADE - Swedish Association for Distance Education, Sweden
- OU - The Open University, United Kingdom

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Preface

The European Association of Distance Teaching Universities (EADTU) is an organisation representing university-level distance teaching institutions in 12 European countries. One of the EADTU objectives is to develop new methods and techniques for higher distance education, and to help meet this objective, EADTU has set up a Working Group on Media and Technology, with representatives from each member institution.

In the context of proposals for European-wide distance education from the European Commission, and in particular proposals for a 'European Open University' and a 'European Electronic University', the EADTU offers this paper as a contribution to the thinking in these areas.

The EADTU would like to draw attention to four points which have been taken as axiomatic in the paper. First, technological applications, no matter how powerful and sophisticated, must serve rather than determine the educational goals and the budgetary constraints of European-wide distance education. In particular, costs to learners must in most cases be kept to a minimum. Second, 'black box' approaches, based on the notion that all learning can be conveyed through a single piece of equipment, are naïve and dangerous. A multi-media approach, including the use of direct human interaction, is essential for effective distance education. Thus while the paper contains scenarios based on single technologies, it is always assumed that these will be placed within a wider context of multi-media course design. Third, the older, more familiar technologies such as print and audio still have much to offer in terms of learning and cost-effectiveness; newer technologies are not automatically superior, and will still need to prove themselves. Lastly, technology alone is not enough; there still needs to be a system of teachers, management, and administration to ensure that courses are properly designed, delivered and supported in the field. Thus the technology needs a sophisticated educational sub-structure to maintain it.

Nevertheless, new technology offers new opportunities for European distance education, which EADTU members are anxious to exploit.

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1. Purpose of paper

The aim of this paper is to *open up* thinking at the start of the course design process about how we might use technology to meet some of the challenges of designing, producing and presenting courses to be produced and delivered across a number of European courses.

Decision-making about media and technology needs to be iterative. Just as it is important to prevent technology driving the decision-making process, so it is equally important that decisions taken early on are at least well informed about the potential (and limitations) of technology.

The more detailed objectives of this paper are as follows:

a. to look at how technology may facilitate the *joint production* of courses across different institutions in different countries

b. to look at how technology may help to *speed up* production

c. to look at how technology may help the *delivery* of courses to different target groups in different countries

d. to suggest prototype course designs that meet the challenge of (a) - (c), and which might extract external funding for at least the technological component

The aim of this paper then is not to make detailed recommendations about the choice of technologies, but to stimulate the course planning teams to take a wide range of technological options into consideration at the start of the course design process.

2. The challenge

The EADTU institutions, in their goal of providing European-wide courses, on a joint production and delivery basis, will need to face challenges that are new to all the institutions. Indeed, the application of

existing methods of course design and delivery may well be inappropriate for these new courses. The new factors are as follows:

1. *The joint production of courses by different institutions across different sites in different countries, in different first languages.* Each institution has its own methods of working, but the majority operate on some form of team approach to course design. How can the team approach work across different countries in different languages? While some meetings will have to be held on a face-to-face basis, a great deal of course material will need to be produced on one site and in one language and transferred to other sites, and considerable time will need to be spent discussing and agreeing on detailed subject matter. It will be essential then to find cost-effective ways of communication between the various project team members.

2. *The need to speed up the process of production and to produce more flexible courses.* Many of the EADTU institutions operate on a minimum of a two-year production cycle, before presentation, with presentation then lasting for five to eight years, or even more, without any major alterations being possible. Because of the complexity of international working, the production stage, if 'traditional' methods of working are used, could take from three to five years. Furthermore, the materials are likely rapidly to get out of date in some of the course areas (e.g. European Law) during the presentation of the course. If current methods of course production and presentation are applied to the new European courses, this could mean:

(a) missing the key date of 1992
(b) increasing costs to an unrealistic level
(c) producing learning material that rapidly becomes out of date
(d) extending the period of course production beyond the time horizons of external funding agencies.

It will be essential to find more cost-effective ways of producing and delivering course materials on a short timescale, and building in the ability to adapt and modify materials during the life of a course.

3. *The need to deliver and to support different courses in different countries.* Traditional methods of course delivery (post, broadcast television, face-to-face tuition) will not necessarily work efficiently on a transborder basis. For instance, broadcast television using terrestrial services will be inappropriate for European-wide delivery. In one country or region, there may not be enough students to support face-to-face tutorials. Telephone tutoring through PTTs will be too expensive across national borders. Alternative methods of delivering materials and supporting students on an international basis will need to be found.

4. *The need to find new course design models that exploit the advantages of new technology.* The need fundamentally to re-think course design and delivery to meet the needs of a continental-wide distance teaching system allows new designs to take into account the potential of new technologies. Thus, instead of having to integrate new technologies into an already complex 'traditional' system of distance education, the European courses provide an ideal test-bed for radically different course designs based on new technologies. Such designs are more likely to attract external funding than course designs based on well-tried methods.

For all these reasons, we need some fresh thinking on the design and delivery of European-wide courses.

3. Criteria for media and technology selection

When considering the suitability of technology for distance education, a number of factors, or criteria, need to be considered. These can best be summarised by the acronym: **ACTION**. This stands for:

Access and availability to students
Costs
Teaching functions
Interaction and user-friendliness
Organisational constraints
Novelty

All these factors need to be considered when choosing technology (see Bates, 1987a for a more detailed discussion of this issue).

3.1 Access.

The first questions to ask in any distance education course are: who is the target group? Will there be open access to the course? If not, what prior qualifications or experience will be necessary? To what level will the students be taught?

In order to make decisions about the media and technology to be used to deliver and support the course, a second set of questions need to be asked. Where and when will the student learn: at home; at his or her work-station; at a local public education centre; or at a work-based training centre? To some extent, this decision will depend on what technology is already available for other purposes. For instance, if every student already has access to their own computer terminal and screen for work purposes, then this might be used also for the distance education course. If the teaching though is to be home-based, and open-access, then account must be made of the limited technology available in homes for every potential student.

Open access, home-based learning will be limited in most European countries to relatively few technologies: print, audio-cassettes, video-cassettes and possibly the telephone (see Bates, 1987 b for a fuller discussion of available technologies for distance education in Europe over the next 10 years).

However, there will be difficulties in home-based open access for several other technologies. Neither satellite TV reception nor home computing is expected to be in more than 65% of homes in any European country by 1996. This could mean that for some home-based target groups (particularly the unemployed and the less educated), these technologies will still be inappropriate for home learning. It also seems unlikely that video discs will be a serious proposition for home-based learning in the near future. Lastly, there are very large national variations in access to

some technologies, particularly regarding cable TV and viewdata (i.e. telephone-based teletext services).

On the other hand, *home-based* distance education targeted at *specific groups*, such as managers or professional people, or education located at the *work-bench* or in *local centres* will be less restricted. For instance, at a reception or work-station cost of between UK£400 and £1000 (600 - 1500 ecus), satellite TV and computer-based learning become realistic propositions for individuals at their work-place, or for people on good incomes. Even video-discs become viable for *local centres*, where they can be shared by several users, or where the cost of alternative forms of education or training is high (e.g on oil-rigs).

Likely access to equipment, and in particular the location of study, is then a crucial factor in choosing technology for European-wide distance education.

3.2 Costs

Some general statements can be made about costs. First, it is important to distinguish between *capital* and *recurrent* expenditure, and *central* (or production) and *local* (or delivery) capital costs. Technologies such as television and computing do require high initial capital expenditure - purchase of a main-frame computer or television studio and equipment; terminals or reception equipment. One problem with capital costs is the rapid obsolescence of equipment, particularly in computing: three to five years may be an appropriate replacement time for a lot of equipment.

Recurrent costs are those that have to be found each year to run the system. This would include the staff required to run the capital equipment (e.g. TV production staff), the money spent on production or purchase of teaching materials, and the cost of delivering it.

Even more important though is the difference between *fixed* and *variable* costs. The cost of a television production may be considered fixed, because it will be the same whether one or 1,000 students view the

programme. Technologies differ considerably in their fixed costs of production, in roughly the following ratios for the same amount of teaching material, as can be seen in Table 1 below (adapted from Sparkes, 1984), which reflect the amount of academic input demanded by various media in producing one hour of teaching material.

Technologies also differ considerably in their *variable* costs for delivery. The variable cost for delivering a broadcast television programme is zero: it costs the same to transmit whether watched by one or one million viewers; video-cassettes on the other hand vary according to the number of delivery points; face-to-face lecturing costs increase in proportion to the number of students - the more students, the more lecturers required.

Table 1: Fixed production costs (including overheads) for one hour of teaching material

Audio-cassette/radio/teleconference/ face-to-face:	1 unit
Televised lecture	2-5 units
Computer-mediated communication	2-5 units
Print	2-10 units
'High-quality' TV programme	20-50 units
Pre-programmed computer-based learning	20-50 units
Computer-controlled video-disc (from scratch)	50-100 units

A number of general points can be made about the balance of costs for different technologies:

1. The cost of putting equipment into local centres or work-stations can far exceed central capital costs (e.g. purchase of a production facility) in certain circumstances (e.g. for organisations with multiple study centres).

2. The major cost of using technologies for teaching is in production and hence recurrent, rather than capital. For instance, the yearly recurrent cost often exceeds the total start-up capital cost. In general, the recurrent costs of producing good quality technology-based materials tend to be underestimated.

3. Technologies vary considerably in their fixed and variable costs. Audio and radio have low fixed and variable costs. Face-to-face teaching and tutor-mediated video instruction have low fixed costs but high variable costs; good quality broadcast television has high fixed costs and low variable costs. CAL (pre-programmed computer-based learning) and video-discs have both high fixed and high variable costs, if work-stations are to be provided. Some of the newer technologies shift the balance between fixed and variable costs. For instance, computer-mediated communication (electronic mail, computer conferencing) is intermediate between the high fixed cost of CAL and the high variable cost of face-to-face tuition.

4. Since for most technologies currently used in national distance teaching institutions, production is the main cost, and hence fixed for any course, *fixed costs usually far exceed variable costs*. This means that the economies of scale apply to 'traditional' distance education courses: the more students, the more cost-effective media become. As a rule of thumb, for high fixed cost media such as good quality television and computer-based learning, in-house or commissioned production is uneconomical (i.e. has higher unit costs than conventional education) unless each course averages 500 students or more a year (or 3,000 to 5,000 in total), or costs are recovered through sales of programmes or hiring out production facilities. For audio plus print, the figures can be reduced by about one tenth. For computer-controlled video-disc production, the minimal course figure is between 2,000 to 5,000 students a year, or 20,000 to 40,000 overall. In-house production of TV and CAL is uneconomical unless a total of at least 50 hours a year of instruction is produced within that medium each year, in order to maximise fixed costs.

5. Broadcast distribution is uneconomical for national distribution with less than 350 students per course for television, or less than 1,000 students per course for audio. Satellite *distribution* is economically viable on a European basis, if the production costs can be justified in terms of the likely target audience.

6. Audio-cassettes are a particularly economical medium; even audio-cassettes plus print is usually a cheaper combination than the cheapest form of video or computer-based learning.

It can be seen that the likely size of a course, in terms of student numbers, is crucial in influencing the choice of technology. One of the benefits of joint production should be that fixed costs are shared between several institutions, and economies of scale apply. This in theory means that some media which in a national context are prohibitively expensive become feasible when available across several institutions in different countries. We shall see however that some of the newer technologies, such as TVI and CMC, are appropriate for relatively small numbers scattered across a wide area.

3.3 Teaching functions

Many might feel that teaching considerations should be the first criterion to be considered. If the technology is not effective, then no matter how cheap, or how convenient it may be for access, it should not be used. However, it is much easier to discriminate between technologies on the basis of access or cost, than it is on teaching effectiveness. Basically, there is a lack of sound theory of media selection based on pedagogic criteria. This is partly because of differences amongst educators about the best way to teach, and partly because media selection has not until recently been a major problem facing educators. Consequently most teachers and trainers have not bothered to use audio-visual media to any significant extent; those that have used media have acted purely on intuition, and have been influenced considerably by what is conveniently available.

There is another reason. Media are flexible. Each medium can be used in a wide variety of ways. Consequently, differences *within* a medium (for instance, between two television programmes, one a televised lecture and the other a documentary) may be greater than *between* media (for instance, between a face-to-face lecture and a lecture on a radio programme).

Nevertheless, intrinsic differences between media are being identified which have implications for teaching and learning, and which can guide media selection.

Media differ in the extent to which they can *represent* different kinds of knowledge. Table 2 indicates some differences. What this means in teaching terms is that some media are better than others for certain kinds of representation of particular significance to teaching.

Table 2: Differences in symbol systems between media

Lecture	Audio	Print	Computer	Television
Voice	Voice	No	No	Voice
Written language	No	Written language	Written language	Written language
Colour	No	?	?	Colour
Still picture	No	Still picture	Still picture	Still picture
No	No	No	Animation	Animation
?	Events	Events	No	Events
No	No	No	No	Full movement

? = usually at higher cost, or only occasionally, or with difficulty

In particular, we can see that media differ in their ability to handle concrete or abstract knowledge. Abstract knowledge is handled primarily through language. We can see that all media can handle language, either in written or spoken form. However, media vary in their ability to handle concrete knowledge. A lecturer may be able to demonstrate an experiment, and both audio and print can report or describe events. None but television though can fully represent events that cannot be brought into the classroom or laboratory, and only television can provide full symbolic representation of events or movement. Television in particular is very rich symbolically, able to handle all forms of representation of knowledge, except direct experience.

This has several consequences for teaching. First, most kinds of abstract knowledge can be handled by any medium, but television in particular, and to some extent print and computers, can provide concrete examples. Thus television can demonstrate processes or procedures, 'model' or construct concrete examples of abstract ideas, demonstrate interpersonal communication, dramatise or reconstruct events through documentary-style production. These representational possibilities are particularly important for non-academic learners, who often require concrete examples or demonstration rather than abstract theory.

However, this form of television is much more expensive to produce than the use of television for relaying lectures. Using television to relay lectures fails to exploit the unique presentational characteristics of television; indeed, audio plus printed notes is equal symbolically to a televised lecture and is more likely to be effective.

Research has also indicated that while abstract ideas or general principles can be represented equally well through any medium, media differ in the extent to which they can help develop different *skills* (Salomon, 1979). Part of this relates to the *control* characteristics of media (see below) and part to the *representational* features. For instance, computers are excellent for presenting and

testing rule-based procedures, or areas of abstract knowledge where there are clearly correct answers. Television on the other hand, because of its richness of symbolic representation, and hence the need for interpretation, is better at handling ambiguous situations, where a variety of possible learner responses are equally acceptable. This is particularly valuable for professional up-dating and training, where trainees already have a good knowledge base, but need to adapt to changing situations. Also, television is valuable for developing mechanical or procedural skills, where it is important to see relationship between parts, and sequencing of activities, for developing inter-personal skills, and for changing attitudes, through the use of dramatisation or documentaries with which the student can clearly identify.

These differences between media indicate the importance of course teams identifying clearly not only the content of a course, but what *kinds* of learning (comprehension, analysis, application of principles to actual cases, problem-solving, inter-personal skills, mechanical skills, attitude change, etc.) are required, and where possible matching these to media selection and use. In turn, this has important implications for examination and assessment procedures. What skills are to be examined, and does the examination process accurately reflect what students have learned through the different media used?

3.4 Interaction and user-friendliness

Another important criterion influencing choice of technology is the *control* over the medium available to the learner. For instance, lectures or broadcasts (terrestrial, cable or satellite) are *ephemeral* media. The value of books, cassettes or computers lies not just in their ability to allow students to view or listen to material at more convenient times. They also enable learning from media to be much more effective. Indeed, the cassette is to the broadcast what the book is to the lecture.

Research has indicated that learning from ephemeral media is much

more difficult than learning from permanent material, like books, cassettes or discs (Bates et al., 1981). Furthermore, there are design implications, once material is available in permanent form. Television material for use on cassette for instance does not have to resemble the continuous, lengthy broadcast format. Video-cassettes can contain short, unlinked sequences, with activities following each sequence, and feedback provided on the activity, either on the cassette itself, or in notes. Video-cassettes in particular lend themselves to group use, because of the need for interpretation and discussion of video examples. This can increase the activity and participation of the learner.

Interactivity - the ability for the learner to respond in some way to the teaching material, and obtain comment or feedback on the response - considerably increases learning effectiveness. This is at its strongest in computer-based learning, where learners can be tested, corrected, or given remedial activities by the computer. The attraction of computer-controlled video-discs is that they combine the strong interactivity of computers with the powerful representational qualities of television. However, we have seen that this is an extremely expensive medium. Audio and video-cassettes can be designed to increase learner interaction, and do allow for more open-ended and interpretative responses than computer-controlled learning.

Perhaps the most important element of control though is the ability for open-ended two-way communication *under the students' control*, allowing students to interact easily not only with tutors, but also with other students. Up to now, the telephone has been the only means of doing this for students at a distance, and costs have been high. A technology now exists though which allows for two-way communication at a distance, at asynchronous times, at low cost, between students, and between students, regional tutors or even central academic staff. This technology is called *computer-mediated communication*. This has revolutionary implications for distance education, providing the means to free students from the centralised control of pre-prepared and constricted curricula.

3.5 Organisational issues

The existing policies and structures within European distance teaching institutions will crucially influence the use of technology for European-wide courses.

Perhaps the most important is the existing technological provision within the partners preparing courses. Thus if all the organisations already have compatible computer networks in place, and technical staff to develop and maintain that network, the introduction of computer-based learning or computer conferencing becomes much easier and more realistic. Introducing the new 'European' courses then becomes a marginal cost on an already established system. Unfortunately, however, that is unlikely to be the case for even the most common technology, print. Some institutions have electronic publishing facilities, others do not. Even those that have electronic publishing may have incompatible systems. Nevertheless, it is likely that the need to exploit the existing technological infrastructure within institutions will be a major conservative influence, limiting the application of new technologies. One of the first tasks that needs to be done to help joint course production and technical collaboration between EADTU institutions is to survey existing communications and computing facilities, to see to what extent systems are compatible.

Another important organisational factor is the existing funding arrangements for course production within partner institutions. If courses have traditionally been based on typeset print, it is likely that the Director of Publishing or Head of Operations has a senior decision-making role, because of his or her control over a large budget. However, introducing the use of a new technology for a European course may require the shift of funds away from 'traditional' budgets into new lines. Indeed, unless this is done, it will be hard to justify the use of new technology on cost grounds. This though is likely to lead to opposition from those who control the budgets of traditional media, who may feel that their power is being eroded. That is why at least an element of external funding will be necessary, if technological

innovation is to happen on these courses.

Lastly, innovation in this area depends essentially on 'champions for change' at a high level: a Rector, Dean or course team member who is willing to fight for the introduction of new technology and approaches. The reverse is also true: inappropriate choice often results from ill-informed champions of a particular technology. Rectors and Deans usually do not have the time to master the knowledge required to make an informed choice of technology for a particular teaching programme. The role of educational technology specialists then becomes important; unfortunately, far too many specialists are not independent, but wedded to a particular technology.

3.6 Novelty

This is perhaps the least important criterion, but it is often easier to get funding for *new* uses of technology. We have seen that audio-cassettes combined with print materials can be a very low-cost but highly effective training medium. But the EADTU institutions are not going to get funded by the European Commission so much for courses based on that technology as they might for courses based on computer-controlled video-discs or satellite voice and data networks. It is easier to 'sell' video-discs, at much higher costs, than the worthy but dull audio-cassette and print.

There are then several factors to be taken into consideration when deciding on the potential use technology for distance education: access, and where learners are to study; costs, particularly production costs, related to numbers of students; teaching requirements, in terms of skills and the kind of learning required; the control characteristics of the media, and the extent to which they encourage active learning; the organisational framework in which technologies will be introduced or exploited; and the novelty value of the proposal.

4. Scenarios for media use in European courses

There are general advantages of an integrated, multi-media approach to distance education. There is no single 'super-medium' that does all teaching tasks cost-effectively; also students vary in their ability to learn from different media. A multi-media approach therefore is likely to be more effective, in learning terms, than over-dependence on a single medium. Nevertheless, there are cost and time implications of a multi-media approach. The more media used, the greater the redundancy of information, the higher the cost of production and delivery, the greater the complexity for course designers, operational units and students, and the greater the chance of overloading students.

It is useful then to think of a 'core' medium, supported by a (limited) range of other media. In most EADTU institutions, the core medium has been type-set print, supported to greater or lesser degrees by audio-cassettes, television and face-to-face teaching. It is suggested that the European courses planning teams should consider other possible media as the core, with support from other media, in order to meet the challenge stated earlier in the paper.

4.1 Electronic publishing

4.1.1. Description

First of all, it is necessary to separate production and delivery of electronic text.

Production. It is technically feasible now for electronic publishing to cover all the stages, from author's first draft right through to access by students. In other words, the author could key in his or her draft to a computer. The draft could be distributed either electronically or through hard copy to the other members of the course, who in turn could send their comments electronically to the author. The author could then make the necessary changes. The editor and graphic

designer could then take the author's final draft, still in electronic format, and prepare a final version for printing, using more powerful electronic editing and art-work procedures.

Electronic publishing can both reduce the costs and increase the speed of production of core texts, it enables core texts to be up-dated more easily, it can save considerably on warehouse costs, through printing on demand each year, and it also allows supplementary materials to be renewed each year at far less development cost.

One consequence of electronic publishing is that it could provide institutions with more flexibility for contracting in subject expertise from outside the institution. Electronic publishing will enable an author at any location to prepare materials for a distance teaching institution, since the draft material can be developed on the subject expert's own computer, and 'despatched' electronically to the distance education institution.

Electronic publishing should also facilitate considerably joint production, and the sharing or adaptation of materials between different institutions, at least where the same language is used, since draft texts can be electronically distributed and edited across different centres.

Distribution. When completed, the final version could then be printed and distributed in the traditional way. Alternatively, the texts could be sent electronically, either on discs through the mail, or transmitted via the telephone as data, to students' home computers, where they could work from their screens.

4.1.2 Possible course scenario

There are two versions: one could limit electronic publishing just to the *production* of the teaching material; the other would include electronic *distribution*.

With regard to production, course team members could produce materials on their own word-processors, and deliver the materials either by mailing discs or by electronic mailing through a variety of possible systems: the EARN academic computer network; the public telephone via the international public packet switching system; or the proposed EADTU voice and data satellite network (JANUS). Drafts could be distributed not just to the 'master production centre' but to members of the course team in each of the other partner sites.

Production would be co-ordinated at one institution. Thus drafts prepared at different centres would be co-ordinated and edited into one master document at one centre. This would allow the master document to be up-dated and modified over time. From this master document laser printed texts could be produced, and mailed to course authors at different institutions, or, if they have end facilities compatible with the master centre, drafts and proofs could be distributed electronically.

When completed, the final version could be either produced through conventional printing techniques from the master document, and mailed to students, or sent electronically, either on discs through the mail, or transmitted via the telephone as data, to students' home computers, where they could work from their screens.

In order to speed up production, courses could be published in various versions. Thus a decision in principle could be taken to allow students access to early drafts of the material.

4.1.3 Requirements

For *production* to happen, a number of requirements need to be met.

1. If locally word-processed materials are to be sent (either electronically or physically) to a central campus for final editing and processing, and to other sites where course team members are working, common systems of word-

processing and operating need to be used (e.g. MS Word and MS-DOS) by authors *across all partner institutions*. This would allow different sites to have different electronic publishing systems, provided that they can all handle author-originated material in these formats.

2. Authors and local editors would require access to the equipment necessary to produce materials in these formats. This will require a suitable work-station (i.e. personal computer of the right standard) and software (word-processing and communications) for each author and editor.

3. Although the skills of word-processing and text transfer are not difficult, some training for authors will be necessary; more important will be local computing support for authors from an in-house computer department or specialists.

4. Communications will be speeded up considerably if there is a suitable local area network on each partner site that connects the various work-stations. It will be speeded up even more if all the sites can be linked electronically.

It seems that some form of joint electronic publishing for production purposes should be quite feasible, given good-will and compromise in agreeing common standards. Several EADTU institutions are already using electronic publishing for production.

The requirements for direct *distribution* electronically to students are much more stringent:

1. A suitable personal computer and software (i.e. compatible with the systems and software used to produce materials): probably MS-DOS or MAC

2. A high-speed modem (capable of delivering at least 36 kbs)

3. A suitable buffer for storing downloaded material while the PC is in operation or switched off; one possible means of distribution might be via satellite data transmission (point-to-multipoint) for those with suitable satellite reception.

4. A suitable printer: the quality of printer will determine the quality of locally printed material. In order to approach anything like desk-top publishing quality, a laser printer will be required.

It can be seen that this system is high-cost for students, and could be justified only for very special target groups.

4.2 Video-cassette courses

4.2.1 Description

Video-cassette technology is now well established in Europe. It is estimated that almost 80% of homes in Britain and more than half the homes in several other EC countries, now have a video recorder (Screen Digest, 1987).

4.2.2 Possible course scenario

The course would centre around high-quality video-cassettes, designed to exploit both the unique presentational qualities of television, and the interactive potential of the stop-start facility. The video-cassettes would be supported by audio-cassettes and a printed course guide, but the 'core' teaching would be on video. Audio-cassettes could be used to give feed-back on the activities built into the video-cassettes. The programmes could either be originally produced from scratch, or could take existing educational broadcast material, and be re-edited for cassette use.

The obvious subject area here would be European Culture, but another area might be European Business Studies, in the form of case-studies.

Because of the high cost of production, the courses would be targeted at large numbers of students, and possibly distributed and sold through high street stores, although there could also be end-of-course supervised examinations. Several different language versions would be produced, but using the same video material. The British OU has two courses where video-cassettes have successfully been used as the core medium.

4.2.3 Requirements

Students would require a video-cassette player. Resources for production would need to be obtained, and suitable methods of marketing the courses would need to be investigated. If existing material is to be used, copyright for European-wide use would be necessary. Some skill would be needed in producing the programmes, both to exploit the presentational and cassette characteristics, and to allow several language versions to be produced without extra video material being required. Several EADTU institutions have the production capacity, if external funding can be found. The main difficulty (apart from funding) would be ensuring that the cassettes are widely available throughout Europe.

4.3 Tutored video instruction (TVI)

4.3.1 Description

TVI originated at Stanford University in California. It involves relaying classroom lectures (by cable, satellite or video-cassette) to a range of different sites, where local face-to-face tutors handle questions and discussion following viewing of the programme. The lectures are usually given by leading experts in the field, specially brought in for the programme. In some variations, students, or more usually tutors, at remote sites can phone in questions to the lecturer, who answers live on-air. TVI is a very low-cost form of television, and allows leading experts, needing little extra preparation, to bring their latest work to a wider audience.

TVI exploits neither the unique presentational characteristics of television nor the control characteristics of cassette or discs. The programmes are usually played straight through as a lecture, although they could be segmented, if intended to be used on cassette. The justification for TVI lies in the low cost and convenience, and its *distributional* characteristics, rather than in the presentational use of the medium.

A variation of TVI is interactive television, a term used in North America for television lectures or panel discussions followed by a live phone-in, with questions answered on air.

Again, this use of television does not attempt to exploit its unique presentational characteristics - it could be presented equally well as a radio programme - but it does exploit the opportunity for open-ended, direct interaction between lecturer and student.

Because TVI suffers from the drawback of all ephemeral media such as lectures, it is best used where information needs to be very up-to-date (e.g. latest research developments), where students already have a good conceptual grasp of the subject matter, and where the presenters are of high status and good lecturers.

4.3.2 Possible course scenario

TVI is already being used in Europe, being distributed via satellite for in-house company training in scientific and technical up-dating, via the EuroPACE programme, or via video-cassettes to companies by the British Open University and other institutions.

Because this approach is more suited to students with already a good conceptual grasp of the overall subject area, European Law might be a suitable course area.

Specialist lecturers (either from EADTU institutions or outside) would be commissioned to give lectures, which would be distributed to local

centres (e.g. a local law firm), at which all students in the area would attend. A local person, with some knowledge in the subject area, would be recruited as a tutor. Several satellite systems would be available for delivering such courses (e.g. ASTRA, Eutelsat, Olympus), all giving European-wide coverage. After delivery of the lecture, the lecturer would be available for questions by telephone from the local centres. Students would take notes from the lectures and the discussion, and there would be a supervised examination at the end of the series. The courses would be repeated each year, with new lectures where they needed to be up-dated. It may be possible to provide multiple language versions (either as a second sound track, or as teletext), if lectures are pre-recorded and translated. Programmes could be originated in several different places in Europe, depending on where the specialists were, and a sub-master video tape of the lecture would be sent to a central transmission or distribution point. The EuroPACE programme in Europe is using satellites for TVI distribution, as does the National Technological University in the USA.

4.3.3 Requirements

1. Suitable specialists need to be identified.

2. A system of distribution to local centres needs to be acquired (satellite or video-cassettes)

3. Suitable local centres and agencies need to be identified, and suitable local tutors recruited.

4. Local centres need to have appropriate reception or play-back equipment.

5. Programmes and contributors need to be timetabled, for interaction via telephone after the programme.

6. Translation facilities may be required.

Again, this is perfectly feasible technically, if an appropriate subject area and funding can be found.

4.4 Computer-mediated communications

4.4.1 Description

Computer-mediated communications allow any student or tutor with access to a computer with word-processing software connected to a telephone to communicate with any other similarly connected student or tutor, in the form of written messages, i.e. via 'electronic mail'. Consequently, tutors can communicate quickly with students and vice versa. An assignment can be sent to the tutor, marked and returned to the student as quickly as the tutor can get round to marking it. Alternatively, tutors and students can join computer 'conferences', where everyone who wishes can contribute comments or discuss a particular topic, and where the conference is available for reading whenever the student wishes, no matter how dispersed the students. Lastly, remote data-bases can be accessed, and information can be copied from the data-base and be down-loaded into the students' or tutors' own computer and stored for later use.

Such services require local micro-computers or terminals, a black-box or integrated chip called a modem which codes the computer information into a suitable form for transmission via the telephone system, a main frame computer on which resides the communications software which acts as the mail system, and good computer communications procedures. Several mainframe computers in different countries can act as 'host' computers, if they are able to 'talk' to one another overnight, to up-date a common system, thus reducing communications costs for the students.

The British Open University has introduced such a computer communication system for 1350 students and 65 tutors studying a course on information technology in 1988.

There are several advantages of electronic communications. First, it is relatively easy for both students and tutors to use. Secondly, there are no 'up-front' production costs, unlike pre-programmed computer-based learning. The teaching and learning occurs through natural communication between teachers and learners. Thirdly, electronic communication allows for other forms of communication, besides didactic teaching, such as discussions, and socialising with other students, if at a distance. Fourth, it allows for a more open-ended and social form of learning than pre-programmed computer-based learning, thus being appropriate for subject areas where interpretation and controversy are important. It also provides a means by which students can negotiate their own areas of study. Lastly, once the communications system is in place, teaching can start relatively quickly, once the main outline of the course has been decided.

4.4.2 Possible course scenario

At the moment, the British Open University is using electronic communications as an additional service for students; it is possible though to envisage certain advanced-level courses where the course design would be radically different, with far greater emphasis on student-tutor communication, both by telephone and electronically, and with far less emphasis on specially prepared texts. This will have major implications for course design, will radically change the role of the academic, and will also radically change the cost structure of a course.

Thus a course could be designed either around existing printed materials, e.g. articles, bulletins and/or set books, or around a dynamic data-base, e.g. bibliographies, laws, case-studies. Tutors (who may be central academic staff) would be responsible for organising and guiding their students through the set reading, for setting assignments or projects, and for marking and advising students on their submissions. Tutors and students would do this as the course progresses, by both telephone and computer communication.

Fixed costs are relatively low, but because costs vary somewhat according to the number of students (more tutors being required), such courses are best restricted to relatively low numbers of students. The main limitation is the telephone charges paid by students when on-line. While many are likely to be on local call rates, in many countries a good proportion will have long distance charges to pay.

Students would have access to a micro-computer, printer and modem connected to the telephone system, and would be linked to one of several mainframe computers through local telephone nodes. (The mainframes will need to 'talk' to one another overnight, to up-date a common system). Copies of relevant articles or publications could either be duplicated and mailed to students (if 'core' reading), or made available on demand through the post, (if 'optional' reading, or if the regulations change, etc.). With rapidly improving optical scanning techniques, it will soon be possible for such articles to be stored electronically and called up by the students through the computer system. Until then, material for the data-base would need to be keyed in, although material can come from any tutor (or student) on the system.

This approach is particularly suitable for fast-changing subject areas, where government regulations keep changing, where the technology is rapidly developing, etc. Furthermore, the data-base can expand each year as students' work is added to it.

4.4.3 Requirements

1. Students will require a home computer, printer and modem, connected to the public telephone system, plus suitable word-processing and communications software.

2. A mainframe computer, with sufficient telephone ports connected to the public system, is required, plus suitable computer conferencing and remote data-base software programmes.

3. Tutors will need a good knowledge of the subject area, in particular sources of information; they will also require the same equipment as students, and will need to be available during the presentation of the course.

This technology is already available, and has been used successfully at the British Open University, although not in the way suggested in the scenario.

4.5 Computer-based learning and video discs

4.5.1 Description

Pre-programmed computer-based learning refers to any form of teaching where the learner is directed by, and interacts with, pre-programmed teaching material contained in the computer software. This is called variously CAL, CBT, CAI, or CBL (computer-based learning). The distinction between CBL and electronic communication is that in the latter case, the interaction is *through* a computer terminal but *with* other sources, such as another learner, tutor or administrator, and not with the computer programme itself.

CBL can present and store information requiring low levels of symbolic representation (e.g. words, numbers and simple line drawings). It is useful for manipulating quantifiable and rule-governed variables, as in simulations. It is useful for testing students' knowledge and identifying areas where further study is necessary. It allows students to work at their own pace and to obtain feedback on their progress.

However, CBL has been around for some time now, and has come in for a great deal of criticism. For instance, CBL often has poor graphics, and no colour or voice input, and there are difficulties in transferring courseware between different types of machines. CBL is often criticised for using poor learning strategies. There is a heavy emphasis on drill and practice, passive page-turning, and the use of limited

responses (single keys or individual keywords). A major problem is that good quality CBL requires more powerful micros than those currently available for home use.

There is of course high quality courseware available and much of it has been developed in distance teaching institutions. However, it is very expensive to produce, and may require on-line access to a mainframe.

Video-discs can be used either in a stand-alone form, in the same way as a video-cassette, but with much more precise and convenient control; or combined with a micro-computer. The latter can be used for video-enhanced pre-programmed computer-based learning, and/or as a huge audio-visual data-base, with the computer enabling access according to any pre-specified criterion.

However, less than 1% of homes in Europe currently have a video-disc player. Laservision (the most suitable form of video-disc technology currently available for education) in particular is being developed primarily for the 'professional' market. Thus while Laservision is likely to be valuable within conventional institutions, summer schools or even study centres, and also at the work-place, where the same programme is required in many outlets, it is unlikely to find its way into a majority of European homes over the next 10 years. Currently, the minimum cost of a computer-controlled video-disc workstation is £2,500 - £3,000 (3,500 - 4,000 ecus), which puts it out of the home market in its present form.

Another limitation on the use of computer-controlled video-discs is the very high cost of production. There are various ways in which these costs can be kept down, e.g. joint production, where the costs are shared by several institutions, or 'generic' discs, which are basically archives of video material, around which an individual institution can write its own computer programme, but even in these instances, production costs are still relatively high, given the likely number of users.

Thirdly, the technological future of video-discs is still uncertain. CD-V (compact disc video) has just reached the consumer market in Japan. These are compact discs which combine sound and pictures, and could also include data. This technology is though just emerging, and as with all new technology of this kind, is initially aimed at the entertainment market. It is not yet clear that it will emerge in a form suitable for education, or if it does, how long it will be before educational material appropriate for distance education is available.

For these reasons, it is difficult to identify a context in which the high cost of production for European-wide courses in either CBL or computer-based video-discs could be justified. However, it is possible that experts from other institutions may want to argue the case for courses based on CBL or interactive video-discs.

5. Conclusions

These scenarios are put forward tentatively, and not as hard and fast proposals. It would be possible to combine some of these technologies, or to use them to support traditional print production. However, the main danger of *adding* these new technologies to existing course designs is that this would merely increase the cost and complexity of course production and design, and thus fail to exploit some of the potential benefits of new technology. The European courses provide an excellent opportunity to test radically new approaches to designing and delivering distance education, appropriate for the 21st century.

Because of national variations, it is useful to separate the *medium* from the *technology* used to deliver that medium. For instance video or television may be considered a medium that can be delivered in a variety of ways - by terrestrial broadcasting, satellite, cassette or even disc. While a course team may decide to use a particular medium then, the delivery of that medium may well differ from country to country in the technology used, dependent on national conditions. Thus television materials might be terrestrially broadcast in the UK,

delivered by cable in Belgium, by satellite in Spain, and by video-disc in the Netherlands. At the same time, it needs to be recognised that the method of delivery will - or should- affect the design of the material, reflecting for instance the ability to stop or ask questions with cassette or disc. What one might envisage then are commonly shared 'core' materials, which may be reconfigured and delivered in different ways in different countries.

There is then little excuse for new EADTU courses to avoid the use of technology in their course design. The technology not only exists but provides the means to overcome some of the substantial difficulties of cross-border, multi-institutional course design, production and delivery. For technology to be used appropriately, though, it is clear that there are policy issues which need to be resolved. These can be put in the form of questions that the course planning teams and the Media and Technology Working Group will need to consider. These can be summarised as follows:

5.1 For course planning teams:

1. What is the target group for the course? Where will they study?

2. How many students will be catered for each year?

3. How long will the courses last, and who will be responsible for the continued presentation of courses?

4. Will there be open access to the course? If not, what prior qualifications or experience will be necessary? To what level will the students be taught?

5. Who will pay for any equipment required: students; employers; the distance teaching institutions?

6. What are the presentational requirements of the subject

area? What student skills are to be developed? What approaches to learning are to be adopted: behaviouristic; cognitive; humanistic? How important is it to encourage students to think for themselves on this course?

7. What languages will be used?

8. What is to be the core medium, and what will be the support media?

5.2 For the Media and Technology Working Group:

9. Should there be a common policy between EADTU institutions regarding home computer systems to be used by students on European courses?

10. Should there be a common policy between EADTU institutions regarding microcomputer systems to be used by academics, secretaries and other staff on European courses?

11. What policy should be adopted by EADTU institutions regarding networking between institutions?

12. What experiences are there in common in the use of different technologies throughout EADTU institutions? Should we collect such information - or is the workshop adequate?

These are all policy issues which need to be answered before final choices can be made about the use of technology on European-wide courses. However, knowing the right questions is half the battle.

Apart from CBL and video-discs, all the proposed course scenarios already exist, usually on a small scale. These are not untried technologies in distance education. Thus while the widescale application of such technologies across national frontiers will be new,

they are technologies available now, which can be used if there is a genuine role for them in the joint courses. Indeed, it could be argued that without the use of such technology, the joint courses themselves may not be practical.

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